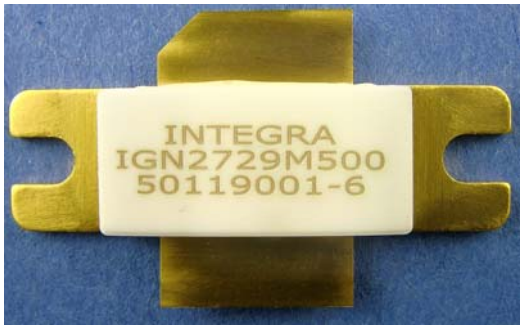
# Part Number: IGN2729M500-IGN2729M500S

Integra
TECHNOLOGIES, INC.

## S-Band Radar Transistor

Available in a bolt down flanged version as IGN2729M500 or in a solder mount earless version IGN2729M500S. IGN2729M500 is an internally pre-matched, gallium nitride (GaN) high electron mobility transistor (HEMT). This part is designed for S-Band radar applications operating over the 2.7 – 2.9 GHz instantaneous frequency band. Under 300us / 10% pulse conditions it supplies a minimum of 500 watts of peak output power with 12dB gain typically. Specified operation is with Class AB bias. When appropriately rated, it is operable under a wide range of pulse widths and duty factors. All devices are 100% screened for large signal RF parameters in a fixed tuned broadband matching circuit / test fixture. The use of external tuners is not allowed during screening. This device is rated for a peak output power level of $P_{PEAK}$ = 500W @ 10% duty factor. This corresponds to an average power $P_{AVG}$ = 50W.




***SAMPLE RF DATA IN BROADBAND RF TEST FIXTURE***

| Lot/SN: | F (GHz) | Pi (W) | Id (A) | RL (dB) | Po (W) | Nd (%) | G (dB) | D (dB) | VSWR 2:1 | VSWR 3:1 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2.7 | 36 | 18.6 | 13 | 574 | 61.7 | 12.03 | -0.12 | S | P |
| 50027112-1 | 2.8 | 36 | 19.73 | 13 | 625 | 63.4 | 12.40 | -0.14 | S | P |
| | 2.9 | 36 | 19.64 | 18 | 615 | 62.6 | 12.33 | -0.17 | S | P |

Vd=50V, Idq=100mA, Vgs=-2.65V, Pulse= 300µs-10%

**GaN on Silicon Carbide FET**
- High Power Gain
- Excellent thermal stability
- Gold Metal

**Depletion Mode Device**
- Negative Gate Voltage to Bias
- Bias Sequencing Required
- See App Note to Prevent Damage

**Gold Metal System**
- Complete Gold System
- Gold Bond Wires
- Gold Package Metal
- Maximum Reliability

**Class AB Operation**
- Specified with AB bias

**Internal Impedance Matching**
- Ease of Use
- Ultra Low Loss Design

**BeO Free Package**
- Metal Based
- Epoxy Seal

**High Power RF Test / Fixture**
- Broadband
- Matched to 50 Ω (ohms)
- Long-term Correlation
- 100% Device RF Screening
- No External Tuning required



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## MAXIMUM RATINGS

| Screen | Parameter | Symbol | Min | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| BD | Drain-Source Voltage | $V_{DS}$ | -- | 60 | V | -- |
| BD | Gate-Source Voltage | $V_{GS}$ | -10 | 0 | V | -- |
| BD | Storage Temperature Range | $T_{STG}$ | -55 | +150 | °C | -- |
| BD | Operating Junction Temperature Range | $T_J$ | -55 | +200 | °C | -- |
| BD | CW Operation | -- | -- | -- | -- | Not rated for CW operation. |
| | | | | | | |
| Note | Screen 'BD' = parameter qualified By Design. | | | | | |

## THERMAL CHARACTERISTICS

| Screen | Parameter | Symbol | Min | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| BD | Thermal Resistance | $R_{TH(JC)}$ | -- | 0.15 | °C/W | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=25°C, $P_{OUT}$=500W |
| | | | | | | |
| Note | Screen 'BD' = parameter qualified By Design. | | | | | |

## PROCESSING SPECIFICATIONS

| Screen | Parameter | Symbol | Min | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|
| 100% | DC Wafer Probe | -- | -- | -- | -- | Per Integra specification. |
| Q1 | Wafer DC and RF Qualification | -- | -- | -- | -- | Per Integra specification. |
| LM | Wire Bond Strength | -- | -- | -- | -- | Line monitor per Integra specification. |
| 100% | Pre-cap visual inspection | -- | -- | -- | -- | Per Integra specification |
| 100% | Gross leak test | -- | -- | -- | -- | MIL-STD-750D, Method 1071.6, Test Condition C |
| | | | | | | |
| Note | Screen 'Q1' = parameter is qualified by assembly and test of 3 pieces minimum per wafer. | | | | | |
| Note | Screen 'LM' = parameter is qualified by assembly line monitor. | | | | | |

## DC ELECTRICAL CHARACTERISTICS

| Screen | Parameter | Symbol | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| 100% | Drain Leakage Current | $I_{D-OFF}$ | -- | -- | 4.0 | mA | $V_{DS}$ = 50V, $V_{GS}$ = -6V, $T_F$ = 25±5°C |
| BD | Gate Threshold Voltage | $V_{GS-TH}$ | -- | -2.8 | -- | V | $V_{DS}$ = 50V, $I_D$ = 100mA, $T_F$ = 25±5°C |



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## RF ELECTRICAL CHARACTERISTICS

| Screen | Parameter | Symbol | Min | Typ | Max | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| 100% | Input Return Loss | IRL | -18 | -12 | -10 | dB | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Output Power | $P_O$ | 500 | 570 | 793 | W | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Power Gain | $G_P$ | 11.43 | 12.00 | 13.43 | dB | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Output Power Flatness $10*LOG(P_{O-MAX}/P_{O-MIN})$ | OPF | 0 | 1.0 | 1.5 | dB | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Drain Efficiency | $N_D$ | 55 | 60 | 75 | % | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Drain Current | $I_D$ | 13 | 20 | 29 | A | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Pulse Amplitude Droop | D | -0.50 | -0.25 | 0.30 | dB | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3. |
| 100% | Insertion Phase | IP | -30 | 0 | +30 | Deg | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F3. |
| 100% | 2:1 Load Mismatch Stability | VSWR-S | 2:1 | -- | -- | -- | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3.<br>Rotate 2:1 output VSWR through 360° phase.<br>No oscillatory or pulse break-up characteristics allowed on detected output pulse. All non-harmonically related signals must be at least –65 dBc. |
| 100% | 3:1 Load Mismatch Tolerance | LMT | 3:1 | -- | -- | -- | $V_{DD}$=V1, $I_{DQ}$=$I_{DQ1}$, PW=PW1, DF=DF1, $T_F$=$T_{F1}$, $P_{IN}$=$P_{IN1}$, F=F1, F2, F3.<br>Rotate 3:1 output VSWR through 360° phase. Post test $P_O$ = Pre test $P_O$±5W |
| | | | | | | | |
| Note 1 | $V1 = 50V$; $I_{DQ1}$ = 100mA; PW1 = 300us; DF1 = 10%, $P_{IN1}$ = 36W. | | | | | | |
| Note 2 | Test Frequencies: F1 = 2.7GHz, F2 = 2.8GHz, F3 = 2.9GHz. | | | | | | |
| Note 3 | All devices are marked with delta insertion phase dash numbers, following the part number, from -1 thru -12 indicating 5° variations between -30° to +30° from reference. | | | | | | |
| Note 4 | $T_{F1}$ = 25±5°C = Device flange temperature. | | | | | | |
| Note 5 | Screen 'BD' = parameter qualified By Design. | | | | | | |

## RF TEST FIXTURE IMPEDANCE CHARACTERISTICS

| Frequency (GHz) | $Z_{IF}$ (Ω) | $Z_{OF}$ (Ω) |
|---|---|---|
| 2.70 | 2.47 –j1.76 | 2.47 –j2.03 |
| 2.80 | 2.49 –j1.69 | 2.35 –j1.82 |
| 2.90 | 2.42 –j1.76 | 2.49 –j1.66 |
| Impedance Definition |  |  |



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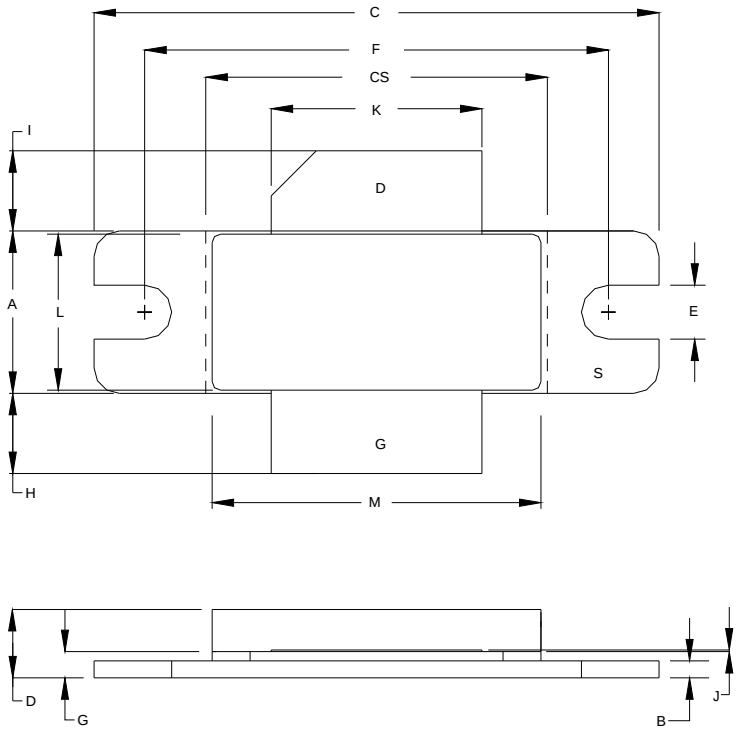
**PACKAGE DIMENSIONAL OUTLINE DRAWING**




'S' VERSION USE DIM CS
NON 'S' VERSION USE DIM C

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.380 | 0.390 | 9.65 | 9.90 |
| B | 0.035 | 0.045 | 0.89 | 1.14 |
| C | 1.335 | 1.345 | 33.90 | 34.16 |
| CS | 0.805 | 0.815 | 20.44 | 20.70 |
| D | 0.139 | 0.166 | 3.53 | 4.21 |
| E | 0.123 | 0.133 | 3.12 | 3.37 |
| F | 1.095 | 1.105 | 27.81 | 28.06 |
| G | 0.057 | 0.067 | 1.44 | 1.70 |
| H | 0.170 | 0.210 | 4.32 | 5.33 |
| I | 0.170 | 0.210 | 4.32 | 5.33 |
| J | 0.003 | 0.006 | 0.08 | 0.15 |
| K | 0.495 | 0.505 | 12.57 | 12.82 |
| L | 0.364 | 0.374 | 9.24 | 9.49 |
| M | 0.772 | 0.788 | 19.60 | 20.01 |

| PIN SCHEDULE | |
|---|---|
| D | DRAIN |
| S | SOURCE |
| G | GATE |



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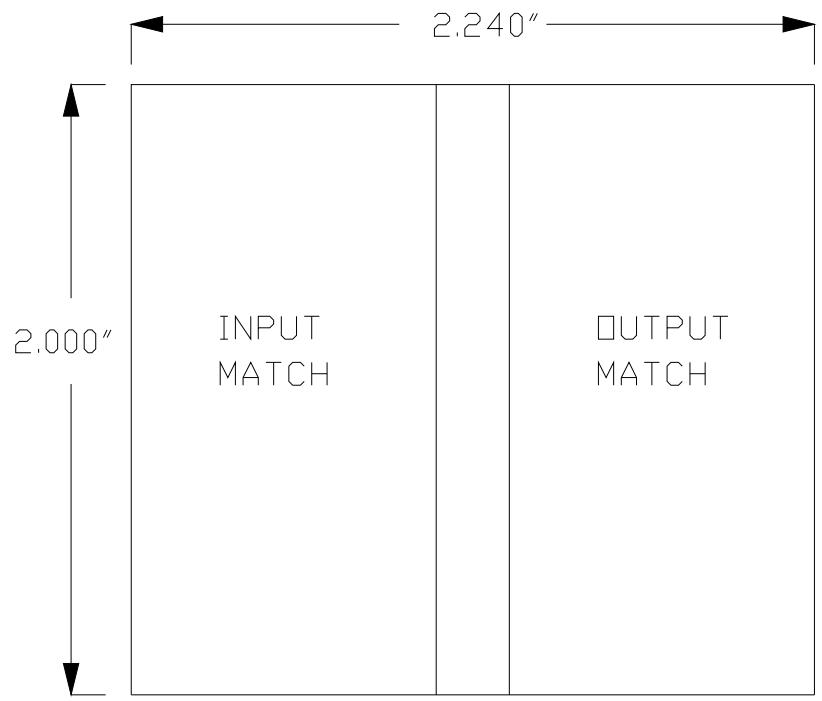
**RF TEST FIXTURE**




**CONTACT FACTORY FOR RF TEST FIXTURE CAD DRAWING WITH CIRCUIT DIMENSIONS AND COMPONENT LIST**



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## DEFINITIONS

| Data Sheet Status | |
|---|---|
| Proposed Specification | This data sheet contains proposed specifications. |
| Preliminary Specification | This data sheet contains specifications based on preliminary measurements and data. |
| Product Specification | This data sheet contains final product specifications. |
| | |
| **Maximum Ratings** | |
| Stress above one or more of the maximum ratings may cause permanent damage to the device. These are maximum ratings only operation of the device at these or at any other conditions above those given in the characteristics sections of the specification is not implied. Exposure to maximum values for extended periods of time may affect device reliability. | |

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